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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)								DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology						
<i>COST (In Thousands)</i>	FY1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	7672	11425	16169	17008	15398	17110	19426	20409	Continuing	Continuing
DK15 Advanced Communications Electronics Countermeasures Demonstration	2701	2810	6893	6917	8096	9104	10848	11408	Continuing	Continuing
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	4971	8615	9276	10091	7302	8006	8578	9001	Continuing	Continuing

A. Mission Description and Budget Item Justification: This program element funds two projects that provide technology options for current and future electronic warfare (EW) systems. The Advanced Communications Electronics Countermeasures Demonstration (DK15) provides technology demonstrations in communications countermeasures (CM), information collection and reporting for transition to Army intelligence, and electronic warfare (IEW) systems through the block improvement process. The effective use of specific components, software and hardware for multiple applications will enable the Army to collect intelligence from modern modulation threat electronic systems in order to disrupt their operation, denying the enemy use of their command, control and communication (C3) assets. This project also supports demonstrations of automatic fusion of intelligence data from multiple sources. Non-Communications Electronic Countermeasures Technology Demonstration (DK16) demonstrates the feasibility and effectiveness of non-communications electronic warfare countermeasures and electronic support/electronic intelligence (ES/ELINT) for self protection from radar, electro-optical, and infrared guided anti-aircraft artillery, surface-to-air missiles, artillery, and top attack weapons, and provides precise targeting information on non-communications emitters. Area protection technology from radar threats is also developed. Work in these projects will lead to technology applications that will significantly contribute to winning the battlefield information war by controlling the electromagnetic spectrum. Work in this program element (PE) supports the multispectral countermeasures advanced technology demonstration, Integrated situation awareness and targeting ATD, the Integrated Countermeasures (ICM) technology demonstration and provides component technology for the hit avoidance technology demonstration. Work in this program element adheres to tri-service Reliance agreements on electronic warfare. Work in this program element is related to and fully coordinated with efforts in PE 0602270A (Electronic Warfare Technology), and various Navy and Air Force program elements in accordance with the on-going Reliance joint planning process. Navy developments are conducted in PEs 0604755N (Ship Self Defense), 0204575N (Electronic Warfare Support), and 0604573N (Shipboard Electronic Warfare Improvements). Air Force developments are conducted in PEs 0604738F (Protective Systems), 0604793F (Tactical Protective Systems) and 0604710F (Reconnaissance Electronics Warfare Systems). Coordination is effected between the Services and Defense Advanced Research Projects Agency (DARPA) to eliminate duplication of effort and ensure the interchange of technical data.

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DATE
February 1999

BUDGET ACTIVITY

3 - Advanced Technology Development

PE NUMBER AND TITLE

0603270A Electronic Warfare (EW) Technology

B. Program Change Summary:	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
Previous President's Budget (<u>FY 1999</u> PB)	7929	11508	16744	18118
Appropriated Value	8182	11508		
Adjustments to Appropriated Value				
a. Congressional General Reductions	-253	-83		
b. SBIR / STTR	-193			
c. Omnibus or Other Above Threshold Reductions	-64			
d. Below Threshold Reprogramming				
e. Rescissions				
Adjustments to Budget Years Since <u>FY 1999</u> PB			-575	-1110
Current Budget Submit (<u>FY 2000</u> PB)	7672	11425	16169	17008

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BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology				PROJECT DK15		
<i>COST (In Thousands)</i>	FY1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK15 Advanced Communications Electronics Countermeasures Demonstration	2701	2810	6893	6917	8096	9104	10848	11408	Continuing	Continuing

Mission Description and Justification: This project demonstrates technology in support of the Army's concept for Force XXI intelligence operations. Communications counter measure and counter-counter measure technologies are demonstrated to provide information warfare and information operations capabilities to intercept, identify, locate and manipulate threat computer networks and their components. Electronic attack products provide the capability to disrupt, deny, degrade or destroy enemy threat computer networks or information resident in those networks. Knowledge gained from demonstration and testing of these technologies and techniques is used to assess vulnerabilities of friendly systems and to develop protection capabilities. In addition, data fusion techniques are being integrated and transitioned to program managers to demonstrate a joint intelligence, surveillance, and reconnaissance product for brigade level and below. Data from traditional intelligence sensors and from non-traditional sources will be integrated to provide situational awareness of red and blue forces. Unmanned aerial vehicle (UAV) payloads employing sensor cross-cueing for rapid target detection and identification will be tested and evaluated. User friendly tools and visualization technology will be demonstrated to provide quality data in a timely manner to enable friendly commanders to operate effectively within the decision cycle of threat commanders. This project focuses on testing, evaluating, and integrating specific information warfare and information operations components, hardware, and software to provide flexible, modern systems and upgrades to existing systems to achieve information dominance, protect the force, and shape the battlespace.

FY 1998 Accomplishments:

- 1290 – Performed field evaluation/demonstration of jamming techniques against modern communication signals.
– Integrated and validated hardware/software solutions to the Tactical Internet addressing exploitable vulnerabilities.
- 846 – Demonstrated a wide bandwidth signal intelligence (SIGINT) electronic support (ES) package on a UAV platform. The ES package successfully detected, intercepted, and relayed radio frequency (RF) signals to existing SIGINT equipment for processing, thereby extending the range of existing SIGINT assets.
- 565 – Successfully demonstrated enhanced operator planning and sensor management tool at Task Force XXI Advanced Warfighting Experiment. Results indicate decreased time for initial placement and redeployment of electronic sensors and electronic attack systems. Tool effectively placed assets to target red forces without disrupting friendly assets.
– Completed SIGINT/moving target indicator (MTI) prototype and demonstrated its sensor cueing capability during limited unit training for Force XXI Battle Command Brigade and Below (FBCB2).
– Tested algorithms to extract terrain features from the National Imagery and Mapping Agency (NIMA) product for improved visualization tools.

Total 2701

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<p>FY 1999 Planned Program:</p> <ul style="list-style-type: none"> • 2030 – Conduct demonstration against modern communication signals using the field programmable gate array analysis/control system. <ul style="list-style-type: none"> – Perform laboratory and field evaluation of capabilities against more complex modern communication signals. – Evaluate command and control attack capabilities against existing security architecture and participate in Initial Operational Test and Evaluation for First Digitized Division. – Evaluate SIGINT payloads for UAVs. – Transition Electronic Support/Electronic Attack techniques to information warfare system. • 723 – Demonstrate and evaluate, through simulation, an automatic target tracking capability based on combined airborne survivability equipment/MTI. <ul style="list-style-type: none"> – Upgrade operator planning and sensor management tool to integrate air and ground based capabilities. Begin transition to GUARDRAIL system. – Evaluate effectiveness of integrating various traditional and non-traditional sensor products to enhance intelligence, surveillance and reconnaissance (ISR) at the Brigade level. • 57 – Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. <p>Total 2810</p> <p>FY 2000 Planned Program:</p> <ul style="list-style-type: none"> • 1800 – Integrate SIGINT/MTI sensor cross-cueing and situation displays into the common ground station and all source analysis system. Complete transition of operator planning tool to GUARDRAIL. <ul style="list-style-type: none"> – Designate system architecture and begin prototyping for joint ISR technology demonstration. Identify joint experiments. • 800 – Prototype UAV payload for sensor cross-cueing to decrease the time required to locate, image, and identify target emitters over a wide area. <ul style="list-style-type: none"> – Integrate technology to provide intelligence collection, counter measures, and counter-counter measures capabilities for tactical units to enable interception, identification, and geolocation of threat emitters in the presence of decoys, deception, and jamming. • 4293 – Demonstrate capability to develop and launch both RF and wired-based attacks against Army information systems as a tool to validate protection mechanisms. <ul style="list-style-type: none"> – Perform interactive testing / validation of Army command and control protection systems against developed attacks. – Conduct vulnerability assessment to evaluate level of security achieved /tool suitability based on test results. – Iteratively revise protect/attack tools to counter newly identified threats. <p>Total 6893</p> <p>FY 2001 Planned Program:</p> <ul style="list-style-type: none"> • 1200 – Test and evaluate initial prototype providing joint ISR capability at the brigade level. • 375 – Integrate ultra-low sidelobe antenna, adaptive power control, and specific emitter identification technology for advanced intelligence collection and countermeasure modular building blocks and prototype air-droppable programmable jammer UAV payload. 		
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology	PROJECT DK15
<ul style="list-style-type: none"> • 1242 – Provide an information operation capability to search for, intercept, identify, locate and manipulate computer networks and their components to detect and recognize threat computers and information resident in those computers. <p>FY 2001 Planned Program: (continued)</p> <ul style="list-style-type: none"> – Provide an information operation capability to disrupt, deny, degrade or destroy information resident in threat computers or computer networks or the computers and networks themselves. <ul style="list-style-type: none"> • 4100 – Leverage results of interactive testing of command and control protection systems to develop attack applications to disrupt/deny threat information systems. – Design and conduct distributed simulation experiments to support development efforts and training for integrated command and control protect and attack capabilities, culminating in a field test for the Digitized Division by FY02. Provide results/recommendations to Program Executive Officer C3S and Program Executive Officer IEW and jointly develop a transition and integration plan. <p>Total 6917</p>		
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BUDGET ACTIVITY 3 - Advanced Technology Development					PE NUMBER AND TITLE 0603270A Electronic Warfare (EW) Technology				PROJECT DK16	

COST (In Thousands)	FY1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	4971	8615	9276	10091	7302	8006	8578	9001	Continuing	Continuing

Mission Description and Justification: This program demonstrates the feasibility and effectiveness of non-communication electronic warfare hardware and software countermeasure technologies for aircraft, ground vehicles, and the dismounted soldier. This provides self-protection against radar, optical, electro-optical and infrared (IR) threats. The multispectral countermeasures advanced technology demonstration provides technology options for product improvements to the suite of integrated infrared countermeasures/common missile warning system (SIIRCM/CMWS), which provides the primary protection to Army helicopters against infrared seeker missiles. Integrated multispectral radar and infrared countermeasures will be demonstrated to provide present and future Army aircraft with full spectrum protection against advanced missiles and integrated air defense systems that can near simultaneously direct radar and infrared homing missiles and fuzed anti-aircraft artillery fire. Integrated Situation Awareness and Targeting (ISAT) ATD and Integrated Countermeasures (ICM) technology demonstration will demonstrate an integrated multispectral suite of precision warning sensors that will provide Army aviation and ground vehicles with full dimensional protection, and demonstrate a “non-traditional “ use of electronic combat systems to provide precision targeting, combat identification, and real time situation awareness updates to other aircraft, ground vehicles, and command and intelligence fusion centers.

FY 1998 Accomplishments:

- 4971 – Completed testing of multispectral countermeasures advanced technology demonstration component modules that will demonstrate technology upgrades for the suite of integrated infrared countermeasures/common missile warning system (SIIRCM/CMWS).
 - Completed integration of solid state, mid infrared laser that will replace neon arc lamp technology in the external jamming pod and provide a significant improvement in jamming output power, and reduce weight, mechanical complexity, and cost.
 - Conducted integration of mid-infrared fiber optic cable that will replace a mechanical, articulated arm used to transmit laser energy from on-board laser module to the external laser jamming pod, and provide a significant improvement in laser beam quality, and reduce weight, mechanical complexity, maintenance requirements, and cost.
 - Collected missile signature data to support improved detection algorithm developments.
 - Developed warning techniques to counter far-IR laser beam rider missiles and munitions, continue research to obtain effective countermeasures.

Total 4971

FY 1999 Planned Program:

- 6838 – Complete integration and survivability integration lab testing of the multispectral countermeasures advanced technology demonstration test bed.
 - Complete aircraft integration and conduct live fire cable car tests to demonstrate the new capability to jam and defeat advanced pseudo imaging and imaging surface to air missiles (SAM).

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<p align="center">– Demonstrate detection and countermeasures against multi-purpose guided missiles that can engage both rotary wing aircraft and ground vehicles.</p> <p>FY 1999 Planned Program: (continued)</p> <ul style="list-style-type: none"> <ul style="list-style-type: none"> – Transition alternative laser technologies, jamming waveforms, fiber optic cable and missile detection algorithms as technology options for SIIRCM product improvement. <ul style="list-style-type: none"> 970 – Develop requirements and design architecture for integrated situation awareness and targeting advanced technology demonstration that will demonstrate multispectral threat warning, geo-location, emitter identification, and situation awareness technology upgrades to the suite of integrated RF countermeasures. – Develop modular sensor to detect and locate laser designated and laser beamrider missiles, and provide information used to select and optimize the appropriate countermeasure response. <ul style="list-style-type: none"> 600 – Integrate digital and hardware-in-the-loop jamming effects models of advanced IR SAMs, anti tank guided missiles (ATGMs) and RF SAM systems into the survivability integration lab to support demonstration of integrated countermeasures technologies. <ul style="list-style-type: none"> 207 – Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. <p>Total 8615</p> <p>FY 2000 Planned Program:</p> <ul style="list-style-type: none"> <ul style="list-style-type: none"> 7876 – Conduct distributed interactive simulations with aviation and ground users to refine integrated sensors and targeting functional modes and operator interfaces. – Test and evaluate multi-wavelength missile warning sensor technologies that will provide extended range detection of missile launches, reduce false alarms, and provide sufficient signature data to allow discrimination of anti-tank from anti-aircraft missiles. – Complete development and testing of laser warning receiver module that provides the capability to locate and discriminate between laser designators and laser beam directors. – Identify communication links, and define variable message format requirements needed to transmit spot reports of missile launch, laser designator/beam director, and radar locations and emitter identification data from aircraft to ground vehicles and command/intelligence fusion centers. – Test and evaluate new time difference of arrival techniques to precisely locate surveillance and targeting air defense radars. (Joint with Naval Research Laboratory) – Test and evaluate algorithms/software for correlating missile warning data and digital terrain elevation data to provide geolocation of missile launch locations. <ul style="list-style-type: none"> 1400 – Develop and conduct hardware-in-the-loop tests of an advanced coherent RF jammer modulator/transmitter to defeat coherent phased array radars and anti-aircraft artillery employing RF fuzes. – Develop and evaluate special RF countermeasures techniques that further reduce the detectability of reduced cross section aircraft. – Develop and evaluate techniques to counter a new generation of IR tracked, command-to-line-of-sight surface- to-air and ATGMs directed against aviation. 		
Project DK16		<p align="center"><i>Page 7 of 8 Pages</i></p> <p align="right">Exhibit R-2A (PE 0603270A)</p>

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Total	9276	
<p>FY 2001 Planned Program:</p> <ul style="list-style-type: none"> <div> <div>8375</div> <div> – Conduct distributed interactive simulations with aviation and ground users to evaluate integrated sensors and targeting functions; define demonstration scenarios and performance measures. – Complete development of compact, multi-wavelength missile warning sensor modules. – Complete development of data fusion software/circuit card modules that provide geolocation of missile launches, radars, laser designators/beam directors, and identify emitters. – Complete development of data fusion software modules to generate situation awareness displays and messages, and select and manage countermeasure responses based on the specific threat. – Integrate integrated situation awareness and targeting hardware/software modules with suite of RF countermeasures testbed and conduct hardware-in-the-loop simulation and testing to verify end-to-end functionality. </div> </div> <div> <div>1716</div> <div> – Develop, integrate and test component technologies for an integrated countermeasures capability. – Integrate and test direct emitting diode (semiconductor) laser jamming source to reduce weight, cost, and prime power while increasing reliability. – Integrate and test DARPA and Army Research Laboratory microwave and millimeter wave power modules to replace traditional traveling wave tube assemblies to reduce transmitter weight and increase reliability and jamming power output. – Integrate and test Air Force-developed closed loop countermeasure techniques that allow the jamming waveform and power to be adapted or modulated based on missile type and range. </div> </div> 		
Total	10091	
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